IMPACT
COMPLIANCE & TESTING

AIR EMISSION TEST REPORT

Title	AIR EMISSION TEST REPORT FOR THE VERIFICATION OF AIR POLLUTANT EMISSIONS FROM NATURAL GAS-FIRED RECIPROCATING ENGINES
Report Date	June 25, 2019
Test Date	May 21, 2019

Facility Information	
Name:	BreitBurn Operating LP – Elmer Fudd East CPF
Street Address:	NE/4 SE/4 Section 7, T28N, R3E, Boiling Springs Road
City, County:	Comins, Oscoda
Facility SRN:	N7463

Emission Unit and Permit Information	
Operating Permit No.:	MI-ROP-N7463-2019
Emission Unit ID Nos.	EUENGINE1 – EUENGINE3

Testing Contractor	
Company:	Impact Compliance & Testing, Inc.
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Project No.:	1900149

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

AIR EMISSION TEST REPORT
FOR THE
VERIFICATION OF AIR POLLUTANT EMISSIONS
FROM
NATURAL GAS-FIRED RECIPROCATING ENGINES

BreitBurn Operating LP – Elmer Fudd East CPF

1.0 INTRODUCTION

BreitBurn Operating L.P (Maverick) operates three (3) Caterpillar (CAT®) Model No. 3516 TALE gas fueled reciprocating internal combustion engines at the BreitBurn Operating LP – Elmer Fudd East CPF, Oscoda County, Michigan. The three (3) natural gas-fueled reciprocating internal combustion engines (RICE) are identified as emission units EUENGINE1, EUENGINE2, and EUENGINE3 (collectively flexible emission group FGENGINES) in Michigan Renewable Operating Permit (ROP) No. MI-ROP-N7463-2019 issued by the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

The conditions of MI-ROP-N7463-2019 specify that:

> The permittee shall verify NOx and CO emission rates from EUENGINE1, EUENGINE2, and EUENGINE3 by testing at the owner's expense, in accordance with the Departments requirements. The test shall be used to develop an emission factor for NOx and CO that will be applied to the monthly fuel use to determine compliance with the 12-month rolling average emission limits in SC I.1 and SC I.2

The compliance testing presented in this report was performed by Impact Compliance & Testing, Inc. (ICT), a Michigan-based environmental consulting and testing company. ICT representatives Tyler Wilson and Clay Gaffey performed the field sampling and measurements May 21, 2019.

The exhaust gas sampling and analysis was performed using procedures specified in the Stack Test Protocol that was reviewed and approved by the EGLE-AQD in the May 10, 2019 Test Plan Approval Letter.

The engine emission performance tests consisted of triplicate, one-hour sampling periods for nitrogen oxides (NOx) and carbon monoxide (CO). Exhaust gas velocity, moisture content, oxygen (O_2) content, and carbon dioxide (CO_2) content were determined for each test period to calculate pollutant mass emission rates.

Questions regarding this emission test report should be directed to:

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Report Certification

This test report was prepared by Impact Compliance & Testing, Inc. based on field sampling data collected by Impact Compliance & Testing, Inc. Facility process data were collected and provided Maverick employees or representatives. This test report has been reviewed by Maverick representatives and approved for submittal to the EGLE.

I certify that the testing was conducted in accordance with the specified test methods and submitted test plan unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.

Report Prepared By:

Jory VanEss
Environmental Consultant
Impact Compliance & Testing, Inc.

Reviewed By:

Tyler J. Wilson
Senior Project Manager
Impact Compliance & Testing, Inc.

2.0 SUMMARY OF TEST RESULTS AND OPERATING CONDITIONS

2.1 Purpose and Objective of the Tests

The conditions of MI-ROP-N7463-2019 require Maverick to test Engine Nos. 1-3 (emission units EUENGINE1, EUENGINE2, and EUENGINE3) for NOx and CO. The test results will be used to develop emission factors for NOx and CO that will be applied to the monthly fuel use to determine compliance with the 12-month rolling average emission limits in SC I.1 and SC I.2.

2.2 Operating Conditions During the Compliance Tests

The testing was performed while the Maverick engine/generator sets were operated at maximum routine operating conditions (within 10% of rated capacity). The rated capacity for the CAT® G3516 TALE engine generator sets are 1,340 horsepower. Maverick representatives provided fuel flowrate (thousand cubic feet (Mcf)) for each test period. The fuel consumption rate ranged between 117.0 and 126.0 Mcf for Engine Nos. 1-3 during the test event. Maverick representatives also recorded engine rotation (rotations per minute (rpm)) every 15-minutes during each test period. Engine rotation rate for Engine Nos. 1-3 ranged from 1,098 to 1,228 rpm during the test event.

Appendix 1 provides operating records provided by Maverick representatives for the test periods.

Table 2.1 presents a summary of the average engine operating conditions during the test periods.

2.3 Summary of Air Pollutant Sampling Results

The gases exhausted from the sampled natural gas-fueled RICE (EUENGINE1, EUENGINE2, and EUENGINE3) were each sampled for three (3) one-hour test periods during the compliance testing performed May 21, 2019.

Table 2.2 presents the average measured NO_X and CO, emission rates for each engine (average of the three test periods).

Test results for each one-hour sampling period and comparison to the permitted emission rates are presented in Section 6.0 of this report.

Table 2.1 Average engine-operating conditions during the test periods

Engine Parameter	EUENGINE1 CAT® G3516 TALE	EUENGINE2 CAT® G3516 TALE	EUENGINE3 CAT® G3516 TALE
Engine Natural-gas fuel use (Mcf)	122	125	117
Engine Rotation (rpm)	1,105	1,132	1,134
Exhaust temperature (°F)	755	751	745

Table 2.2 Average measured emission rates for each engine (three-test average)

Emission Unit	CO Emission Rates		NOx Emission Rates	
	(lb/hr)	(TPY)	(lb/hr)	(TPY)
EUENGINE1	2.93	12.8	4.03	17.7
EUENGINE2	2.95	12.9	5.99	26.2
EUENGINE3	2.46	10.8	4.75	20.8
Permit Limit (Per Engine)	-	*32.8*	-	*45.3*
Total	-	36.5	-	64.7
Facility Wide Limit	-	*98.7*	-	*136*

3.0 SOURCE AND SAMPLING LOCATION DESCRIPTION

3.1 General Process Description

Maverick operates three (3) CAT® Model No. G3516 TALE RICE engines at the Elmer Fudd East CPF station. The units are fired exclusively with natural gas.

3.2 Rated Capacities and Air Emission Controls

The CAT® G3516 TALE engine sets have a rated design capacity of:

- Engine Power: 1,340 bhp

Each RICE is equipped with an electronic air-to-fuel ratio (AFR) controller that blends the appropriate ratio of combustion air and natural gas fuel. The electronic AFR controller monitors engine performance parameters and automatically adjusts the AFR and ignition timing to maintain efficient fuel combustion.

The RICE are not equipped with add-on emission control devices. The AFR controller maintains efficient fuel combustion, which minimizes air pollutant emissions. Exhaust gas is exhausted directly to atmosphere through a noise muffler and vertical exhaust stack.

3.3 Sampling Locations

The RICE exhaust gas is directed through a muffler and is released to the atmosphere through a dedicated vertical exhaust stack with a vertical release point.

The exhaust stack sampling ports for the CAT® Model G3516 TALE engines (EUENGINE1, EUENGINE2, and EUENGINE3) are located before the muffler in a horizontal exhaust duct with an inner diameter of 12.5 inches. The duct is equipped with two (2) sample ports, opposed 90°, that provide a sampling location >45.0 inches (>3.6 duct diameters) upstream and >50.0 inches (>4.0 duct diameters) downstream from any flow disturbance.

All sample port locations satisfy the USEPA Method 1 criteria for a representative sample location. Individual traverse points were determined in accordance with USEPA Method 1.

Appendix 2 provides diagrams of the emission test sampling locations.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

A test protocol for the air emission testing was reviewed and approved by the EGLE-AQD. This section provides a summary of the sampling and analytical procedures that were used during the testing periods.

4.1 Summary of Sampling Methods

USEPA Method 1	Exhaust gas velocity measurement locations were determined based on the physical stack arrangement and requirements in USEPA Method 1.
USEPA Method 2	Exhaust gas velocity pressure was determined using a Type-S Pitot tube connected to a red oil incline manometer; temperature was measured using a K-type thermocouple connected to the Pitot tube.
USEPA Method 3A	Exhaust gas O_2 and CO_2 content was determined using paramagnetic and infrared instrumental analyzers, respectively.
USEPA Method 4	Exhaust gas moisture was determined based on the water weight gain in chilled impingers.
USEPA Method 7E	Exhaust gas NOx concentration was determined using chemiluminescence instrumental analyzers.
USEPA Method 10	Exhaust gas CO concentration was measured using an infrared instrumental analyzer.

4.2 Exhaust Gas Velocity Determination (USEPA Method 2)

The RICE exhaust stack gas velocities and volumetric flow rates were determined using USEPA Method 2 once for each test period. An S-type Pitot tube connected to a red-oil manometer was used to determine velocity pressure at each traverse point across the stack cross section. Gas temperature was measured using a K-type thermocouple mounted to the Pitot tube. The Pitot tube and connective tubing were leak-checked onsite prior to the test event to verify the integrity of the measurement system.

The absence of significant cyclonic flow at the sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each velocity traverse point with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

Appendix 3 provides exhaust gas flowrate calculations and field data sheets.

4.3 Exhaust Gas Molecular Weight Determination (USEPA Method 3A)

CO_2 and O_2 content in the RICE exhaust gas stream was measured continuously throughout each test period in accordance with USEPA Method 3A. The CO_2 content of the exhaust was monitored using a Servomex 1440D single beam single wavelength (SBSW) infrared gas analyzer. The O_2 content of the exhaust was monitored using a Servomex 1440D gas analyzer that uses a paramagnetic sensor.

During each sampling period, a continuous sample of the RICE exhaust gas stream was extracted from the stack using a stainless steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the analyzers; therefore, measurement of O_2 and CO_2 concentrations correspond to standard dry gas conditions. Instrument response data were recorded using an ESC Model 8816 data acquisition system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document). Sampling times were recorded on field data sheets.

Appendix 4 provides O_2 and CO_2 calculation sheets. Raw instrument response data are provided in Appendix 5.

4.4 Exhaust Gas Moisture Content (USEPA Method 4)

Moisture content of the RICE exhaust gas was determined in accordance with USEPA Method 4 using a chilled impinger sampling train. The moisture sampling was performed concurrently with the instrumental analyzer sampling. During each sampling-period, a gas sample was extracted at a constant rate from the source where moisture was removed from the sampled gas stream using impingers that were submersed in an ice bath. At the conclusion of each sampling period, the moisture gain in the impingers was determined gravimetrically by weighing each impinger to determine net weight gain.

4.5 NO_x and CO Concentration Measurements (USEPA Methods 7E and 10)

NO_X and CO pollutant concentrations in the RICE exhaust gas streams were determined using a Thermo Environmental Instruments, Inc. (TEI) Model 42c High Level chemiluminescence NO_X analyzer and a TEI Model 48i infrared CO analyzer.

Throughout each test period, a continuous sample of the engine exhaust gas was extracted from the stack using the Teflon® heated sample line and gas conditioning system and delivered to the instrumental analyzers. Instrument response for each analyzer was recorded on an ESC Model 8816 data acquisition system that logged data as one-minute averages. Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias.

Appendix 4 provides CO and NO_X calculation sheets. Raw instrument response data are provided in Appendix 5.

5.0 QA/QC ACTIVITIES

5.1 Flow Measurement Equipment

Prior to arriving onsite, the instruments used during the source test to measure exhaust gas properties and velocity (barometer, pyrometer, and Pitot tube) were calibrated to specifications in the sampling methods.

The absence of cyclonic flow for each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each of the velocity traverse points with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

5.2 NO_x Converter Efficiency Test

The NO_2 – NO conversion efficiency of the Model 42c analyzer was verified prior to the testing program. A USEPA Protocol 1 certified concentration of NO_2 was injected directly into the analyzer, following the initial three-point calibration, to verify the analyzer's conversion efficiency. The analyzer's NO_2 – NO converter uses a catalyst at high temperatures to convert the NO_2 to NO for measurement. The conversion efficiency of the analyzer is deemed acceptable if the measured NO_2 concentration is greater than or equal to 90% of the expected value.

The NO_2 – NO conversion efficiency test satisfied the USEPA Method 7E criteria (measured NO_2 concentration was 99.1% of the expected value, i.e., greater than 90% of the expected value as required by Method 7E).

5.3 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

5.4 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure NO_X, CO, O_2, and CO_2 have had an interference response test preformed prior to their use in the field, pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to measure. All of analyzers exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

5.5 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the NO_x, CO, CO_2, and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the stainless steel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2, O_2, NO_x, and CO in nitrogen and zeroed using hydrocarbon free nitrogen. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

5.6 Determination of Exhaust Gas Stratification

A stratification test was performed for each RICE exhaust stack. The stainless steel sample probe was positioned at sample points correlating to 16.7, 50.0 (centroid) and 83.3% of the stack diameter. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded concentration data for the RICE exhaust stacks indicated that the measured O_2 and CO_2 concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the RICE exhaust gas was considered to be unstratified and the compliance test sampling was performed at a single sampling location within each RICE exhaust stack.

5.7 Meter Box Calibrations

The dry gas meter and sampling console, which was used for exhaust gas moisture content sampling, was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5.

The digital pyrometer in the Nutech metering consoles were calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

Appendix 6 presents test equipment quality assurance data (NO_2 – NO conversion efficiency test data, instrument calibration and system bias check records, calibration gas and gas divider certifications, interference test results, meter box calibration records, Pitot tube calibration records, and stratification checks).

6.0 <u>RESULTS</u>

6.1 Test Results and Allowable Emission Limits

Engine operating data and air pollutant emission measurement results for each one-hour test period are presented in Tables 6.1 through 6.3.

The measured air pollutant concentrations and emission rates for EUENGINE1, EUENGINE2, and EUENGINE3 are less than the allowable limits specified in MI-ROP-N7463-2019.

Emission limits specified for FGENGINES:

- 45.3 tpy (12-month rolling time period) for NOx; and
- 32.8 tpy (12-month rolling time period) for CO.

Emission limits specified for Source Wide Emissions:

- 136 tpy (12-month rolling time period) for NOx; and
- 98.7 tpy (12-month rolling time period) for CO.

6.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing for all pollutants was performed in accordance with USEPA methods and the approved Stack Test Protocol. The engine-generator sets were operated within 10% of maximum output and no variations from normal operating conditions occurred during the engine test periods.

Table 6.1 Measured exhaust gas conditions and NO_x and CO air pollutant emission rates for Engine No. 1 (EUENGINE1)

Test No. Test date Test period (24-hr clock)	1 5/21/19 7:00-8:00	2 5/21/19 8:19-9:19	3 5/21/19 9:34-10:34	Three Test Average
Natural Gas Usage (Mcf)	122	122	123	122
Engine Rotation (rpm)	1,105	1,106	1,104	1,105
Exhaust Gas Composition				
CO_2 content (% vol)	9.24	9.24	9.23	9.24
O_2 content (% vol)	7.15	7.16	7.17	7.16
Moisture (% vol)	12.9	13.3	12.1	12.8
Exhaust gas temperature (°F)	746	774	744	755
Exhaust gas flowrate (dscfm)	1,072	1,169	1,113	1,118
Exhaust gas flowrate (scfm)	1,231	1,348	1,266	1,282
Nitrogen Oxides				
NO_X conc. (ppmvd)	490	509	509	503
NO_X emissions (lb/hr)	3.77	4.26	4.06	4.03
NO_X emissions (TPY)	16.5	18.7	17.8	17.7
Permitted emissions (TPY)	-	-	-	*45.3*
Carbon Monoxide				
CO conc. (ppmvd)	595	602	600	599
CO emissions (lb/hr)	2.79	3.07	2.92	2.93
CO emissions (TPY)	12.2	13.5	12.8	12.8
Permitted emissions (TPY)	-	-	-	*32.8*

Table 6.2 Measured exhaust gas conditions and NO_X and CO air pollutant emission rates for Engine No. 2 (EUENGINE2)

Test No. Test date Test period (24-hr clock)	1 5/21/19 11:14-12:14	2 5/21/19 12:25-13:25	3 5/21/19 13:37-14:37	Three Test Average
Natural Gas Usage (Mcf)	124	125	126	125
Engine Rotation (rpm)	1,126	1,145	1,126	1,132
Exhaust Gas Composition				
CO_2 content (% vol)	8.75	8.21	8.75	8.57
O_2 content (% vol)	7.89	7.79	7.87	7.85
Moisture (% vol)	12.7	12.7	12.8	12.7
Exhaust gas temperature (°F)	751	740	761	751
Exhaust gas flowrate (dscfm)	1,216	1,217	1,215	1,216
Exhaust gas flowrate (scfm)	1,394	1,394	1,392	1,393
Nitrogen Oxides				
NO_X conc. (ppmvd)	639	661	760	687
NO_X emissions (lb/hr)	5.57	5.77	6.62	5.99
NO_X emissions (TPY)	24.4	25.3	29.0	26.2
Permitted emissions (TPY)	-	-	-	*45.3*
Carbon Monoxide				
CO conc. (ppmvd)	566	531	569	555
CO emissions (lb/hr)	3.01	2.82	3.02	2.95
CO emissions (TPY)	13.2	12.4	13.2	12.9
Permitted emissions (TPY)	-	-	-	*32.8*

Table 6.3 Measured exhaust gas conditions and NO_X and CO air pollutant emission rates for Engine No. 3 (EUENGINE3)

Test No. Test date Test period (24-hr clock)	1 5/21/19 14:52-15:52	2 5/21/19 16:03-17:03	3 5/21/19 17:15-18:15	Three Test Average
Natural Gas Usage (Mcf)	117	118	117	117
Engine Rotation (rpm)	1,147	1,127	1,127	1,134
Exhaust Gas Composition				
CO_2 content (% vol)	8.76	8.22	8.74	8.57
O_2 content (% vol)	7.91	7.81	7.91	7.88
Moisture (% vol)	12.5	12.3	12.6	12.5
Exhaust gas temperature (°F)	741	746	749	745
Exhaust gas flowrate (dscfm)	994	999	1,021	1,005
Exhaust gas flowrate (scfm)	1,136	1,138	1,168	1,147
Nitrogen Oxides				
NO_X conc. (ppmvd)	541	668	767	658
NO_X emissions (lb/hr)	3.85	4.78	5.61	4.75
NO_X emissions (TPY)	16.9	20.9	24.6	20.8
Permitted emissions (TPY)	-	-	-	*45.3*
Carbon Monoxide				
CO conc. (ppmvd)	556	572	556	561
CO emissions (lb/hr)	2.41	2.49	2.48	2.46
CO emissions (TPY)	10.6	10.9	10.9	10.8
Permitted emissions (TPY)	-	-	-	*32.8*

APPENDIX 1

- Facility Operating Records

Natural Gas Fueled Internal Combustion Engine Process Operating Data

Facility Name: Maverick / Breitburn
Location: Comins, MI
Test Date: 5/21/19

Engine ID: 1185
Serial No.: 65000447
Operating Hrs.: 76,930

TEST NO. 1
Start Time: 7:00

	Engine Rotation (rpm)	Natural Gas Fuel Use (scfm)
0 min	1,103	
15 min	1,109	
30 min	1,106	
45 min	1,103	
60 min	1,103	

Stop Time: 8:00

TEST NO. 2
Start Time: 8:19

	Engine Rotation (rpm)	Natural Gas Fuel Use (scfm)
0 min	1,108	
15 min	1,099	
30 min	1,109	
45 min	1,108	
60 min	1,108	

Stop Time: 9:19

TEST NO. 3
Start Time: 9 34

	Engine Rotation (rpm)	Natural Gas Fuel Use (scfm)
0 min	1098	
15 min	1,107	
30 min	1,110	
45 min	1,102	
60 min	1,105	

Stop Time: 1034

Operator Initials: CG

Note - Operating hours are recorded at the beginning of the first test.

Natural Gas Fueled Internal Combustion Engine Process Operating Data

Facility Name: Maverick
Location: Comins, MI
Test Date: 5/21/19

Engine ID: 1106
Serial No.: 6500391
Operating Hrs.: 79,798

TEST NO. 1
Start Time: 11:14

	Engine Rotation (rpm)	Natural Gas Fuel Use (scfm)
0 min	1,129	
15 min	1,125	
30 min	1,125	
45 min	1,125	
60 min	1,124	

Stop Time: 12:14

TEST NO. 2
Start Time: ~~1403~~ 1225

	Engine Rotation (rpm)	Natural Gas Fuel Use (scfm)
0 min	1,127	
15 min	1,126	
30 min	1,125	
45 min	1,124	
60 min	1,124	

Stop Time: 1325

TEST NO. 3
Start Time: 1337

	Engine Rotation (rpm)	Natural Gas Fuel Use (scfm)
0 min	1,126	
15 min	1,127	
30 min	1,126	
45 min	1,125	
60 min	1,126	

Stop Time: 1437

Operator Initials: CG

Note - Operating hours are recorded at the beginning of the first test.

Natural Gas Fueled Internal Combustion Engine Process Operating Data

Facility Name: Maverick
Location: Comins, MI
Test Date: 5/21/19

Engine ID: 1107
Serial No.: 65000415
Operating Hrs.: 82,613

TEST NO. 1
Start Time: 14:52

	Engine Rotation (rpm)	Natural Gas Fuel Use (scfm)
0 min	1,127	
15 min	1,128	
30 min	1,127	
45 min	1,128	
60 min	1,127	

Stop Time: 15:52

TEST NO. 2
Start Time: 1603

	Engine Rotation (rpm)	Natural Gas Fuel Use (scfm)
0 min	1,127	
15 min	1,128	
30 min	1,127	
45 min	1,126	
60 min	1,126	

Stop Time: 1703

TEST NO. 3
Start Time: 1715

	Engine Rotation (rpm)	Natural Gas Fuel Use (scfm)
0 min	1,126	
15 min	1,126	
30 min	1,127	
45 min	1,127	
60 min	1,127	

Stop Time: 1815

Operator Initials: CG

Note - Operating hours are recorded at the beginning of the first test.

Facility Name: Maverick / Breitburn - Elmer Fudd East
Location: Comins, MI
Test Date: 5/21/2019

Engine No. 1 (1185)
Serial No.: 65000447
Operating Hours: 76,930

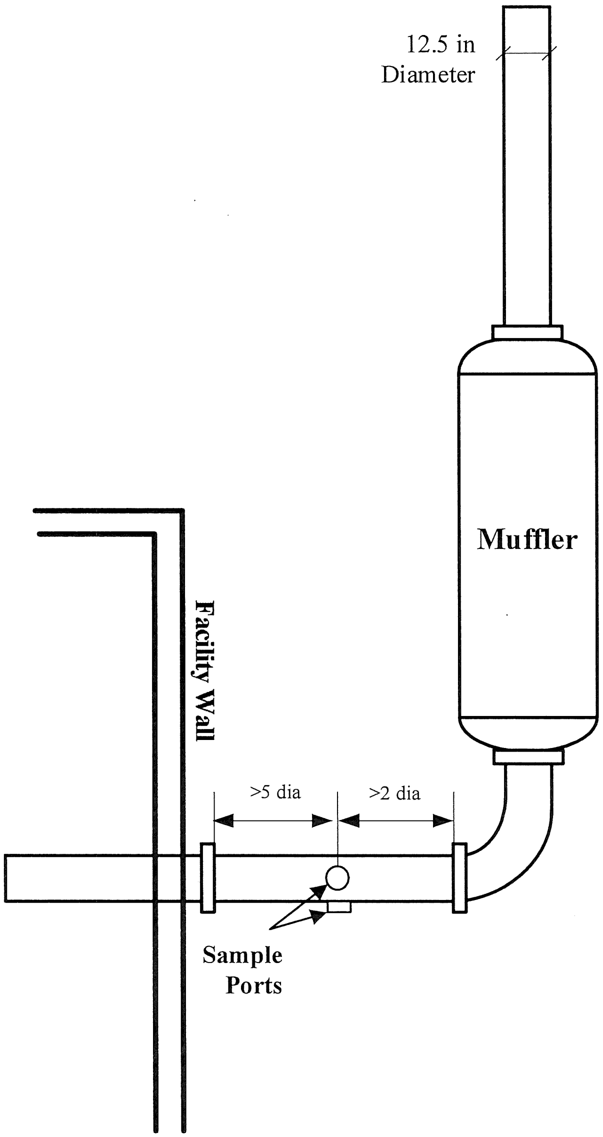
Start Time	Engine Rotation (rpm)	Natural Gas Usage (Mcf)
Test 1		
7:00	1,103	-
-	1,109	-
-	1,106	-
-	1,103	-
8:00	1,103	-
	1,105	121.5
Test 2		
8:19	1,108	-
-	1,099	-
-	1,109	-
-	1,108	-
9:19	1,108	-
	1,106	122.0
Test 3		
9:34	1,098	-
-	1,107	-
-	1,110	-
-	1,102	-
10:34	1,105	-
	1,104	123.0
	1,105	

Engine No. 2 (1106)
Serial No.: 65000391
Operating Hours: 79,798

Start Time	Engine Rotation (rpm)	Natural Gas Usage (Mcf)
Test 1		
11:14	1,129	-
-	1,125	-
-	1,125	-
-	1,125	-
12:14	1,124	-
	1,126	124.0
Test 2		
12:25	1,127	-
-	1,126	-
-	1,125	-
-	1,124	-
13:25	1,224	-
	1,145	125.0
Test 3		
13:37	1,126	-
-	1,127	-
-	1,126	-
-	1,125	-
14:37	1,126	-
	1,126	126.0
	1,132	

Engine No. 3 (1107)
Serial No.: 65000415
Operating Hours: 82,613

Start Time	Engine Rotation (rpm)	Natural Gas Usage (Mcf)
Test 1		
14:52	1,127	-
-	1,128	-
-	1,127	-
-	1,228	-
15:52	1,127	-
	1,147	117.0
Test 2		
16:03	1,127	-
-	1,128	-
-	1,127	-
-	1,126	-
17:03	1,126	-
	1,127	117.5
Test 3		
17:15	1,126	-
-	1,126	-
-	1,127	-
-	1,127	-
18:15	1,127	-
	1,127	117.0
	1,134	



4-12-19	**BreitBurn Operating LP – Elmer Fudd East Exhaust Sample Location, CAT G3516 Engine**		
	Scale None	Sheet 1 of 1	ICT Project No 1900149